

REMARKS

Examiner Nadav is thanked for his thorough examination of the Subject Patent Application. Amendments have been made to the Claims and in so doing are now believed to be render the Claims distinguishable from Examiners cited prior art and therefore be in condition for allowance.

Referring to the rejection of the Claims based on 35 USC 112, the term “continuous upper level metal interconnect structure” has been amended to -- an upper level metal interconnect structure--, which is described in the specification on page 8, line 2. Other items included in these Claims such as “lower level metal interconnect structure”, have also been described the specification (page 5, line 3). Therefore reconsideration of the rejection of Claims 20 - 24, based on 35 USC 112, is requested as a result of the amendments made.

Referring to the rejection of Claims 20 and 24, under 35 USC 102, as being anticipated by Harada et al (US 5,341,026), independent Claim 20, has been amended to more clearly describe applicants structure and in so doing become clearly distinguishable from the Harada et al prior art. Independent Claim 20, now clearly describes metal spacers on the top portion of the via hole, non-connected or non - continuous metal spacers resulting in a space, which exposes a portion of the top surface of the recessed metal plug. This is clearly shown in applicant's top view Fig 7A schematic. It can be seen in Fig. 7A, that a portion of the top surface of the recessed metal plug 7b, is exposed, with the exposed space surrounded by non-connected metal spacers 8c. In

contrast the Harada et al prior art shows a continuous metal structure 103, without a space exposing a portion of the top surface of a metal plug structure. In addition the Harada et al prior art show metal structure 103, on all the top surfaces of ILD layer 5. In contrast applicant's unique structure shows upper level metal structure 8b, only overlying ILD layer 4, on one side of the via hole used to accommodate recessed metal plug structure 7b. These unique features of applicant's structure, (space between non-connected metal spacers at the bottom of the via hole, exposing a portion of a top surface of the recessed metal plug structure, and upper level metal structure 8, only on one side of the via hole), are not described in Examiner's cited prior art. Therefore reconsideration of Claims 20 and 24, under 35 USC 102, is requested based on the amendments made and the arguments presented.

Regarding the rejection of Claims 21 - 23, under 35 USC 103, the amendments made to the Claims, and the arguments presented in response to the 35 USC 102 rejection, are again used. No prior art describes the unique features of applicants structure, such as the space between metal spacers exposing a portion of the top surface of the recessed metal plug structure, and upper level metal structure 8, only on one side of the via hole. These dependent Claims now refer to amended independent Claim 20. Therefore no combination of prior art can be used to offer applicants structure. Applicant has claimed his process in detail. The structure shown in Figs. 7A and 7B, and in Claims 20- 24, are both believed to be novel and patentable over Examiners cited art references, because there is no evidence that these prior arts described a metal interconnect structure comprised with attached metal spacers with the unique feature of leaving a space

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between the sidewall metal spacers that allow exposure of a portion of the top surface of an underlying metal plug. We therefore request Examiner Nadav to reconsider his rejection of Claims 21 - 24, under 35 USC 103, in view of these arguments and the amendments to the Claims.

Allowance of all Claims is requested.

Attached hereto is a marked-up version of the changes made to the Claims by the current amendment. The attached page is captioned.

"Version with markings to show changes made"

It is requested that should Examiner Nadav not find that the Claims are now Allowable that he call the undersigned attorney at 845-452-5863, to overcome any problems preventing allowance.

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

PLEASE AMEND THE CLAIMS AS FOLLOWS:

20. (TWICE AMENDED) [A continuous] An upper level [,] metal interconnect structure[,]
[comprised of a single metal element,] on a semiconductor substrate, comprised of a
metal structure located on a smooth top surface of an underlying insulator layer, and an
attached metal ring structure in turn comprised of metal spacers, comprising:

5 a lower level [,] metal interconnect structure;

 [an] said insulator layer located on said lower level [,] metal interconnect structure;

 a via hole in said insulator layer exposing a portion of a top surface of said lower
level [,] metal interconnect structure;

 a recessed metal plug structure[,] located in a bottom portion of said via hole, with
10 said recessed metal plug structure overlying and contacting the portion of said lower
level [,] metal interconnect structure, exposed in said via hole; and

5 said [continuous] upper level [,] metal interconnect structure, comprised of [a] said metal structure [component] and comprised of attached [a] said metal ring [component] structure, [with] wherein said metal structure [component] is located only on one side of via hole on a portion of a top surface of said insulator layer, and also located on an edge of underlying, said recessed metal plug structure, and [with] wherein said metal ring [component] structure, attached to said metal structure, is [component and] located overlying, and contacting only portions of a top surface of said recessed metal plug structure, with said metal ring [component] structure comprised of metal spacers on the sides of a top portion of said via hole with a space located between said metal spacers 10 exposing a portion of a top surface of said recessed metal plug structure.

21. (TWICE AMENDED) The [continuous] upper level[,] metal interconnect structure of claim 20, wherein said lower level[,] metal interconnect structure is comprised of a composite metal structure, featuring an aluminum, or an aluminum based layer, at a thickness between about 2000 to 20000 Angstroms, with an underlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, and an overlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms.

22.(TWICE AMENDED) The [continuous] upper level [,] metal interconnect structure of claim 20, wherein said via hole is comprised with a diameter between about 0.10 to 1.0 um.

23. (TWICE AMENDED) The [continuous] upper level[,] metal interconnect structure of claim 20, wherein said recessed metal plug structure, is comprised of tungsten, with the height of said recessed metal plug structure, located in said bottom portion of said via hole, between about 3000 to 20000 Angstroms.

24. (TWICE AMENDED) The [continuous] upper level[,] metal interconnect structure of claim 20, wherein said metal ring structure, attached to said metal interconnect structure [component] of said upper level [,] metal interconnect structure, is comprised of aluminum, or aluminum - copper spacers, located on the sides of said top portion of said via hole.